1. What are the *possible Rational* roots of the polynomial below?

$$f(x) = 7x^3 + 7x^2 + 3x + 5$$

A. All combinations of: $\dfrac{\pm 1, \pm 5}{\pm 1, \pm 7}$

B. $\pm 1, \pm 7$

C. $\pm 1, \pm 5$

D. All combinations of: $\dfrac{\pm 1, \pm 7}{\pm 1, \pm 5}$

E. There is no formula or theorem that tells us all possible Rational roots.

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2. What are the *possible Rational* roots of the polynomial below?

$$f(x) = 4x^4 + 3x^3 + 3x^2 + 3x + 6$$

A. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 3, \pm 6}{\pm 1, \pm 2, \pm 4}$

B. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 4}{\pm 1, \pm 2, \pm 3, \pm 6}$

C. $\pm 1, \pm 2, \pm 4$

D. $\pm 1, \pm 2, \pm 3, \pm 6$

E. There is no formula or theorem that tells us all possible Rational roots.

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3. Factor the polynomial below completely, knowing that $x + 5$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 9x^4 + 27x^3 - 127x^2 - 155x + 150$$

A. $z_1 \in [-5.2, -4.9]$, $z_2 \in [-1.81, -1.57]$, $z_3 \in [0.65, 0.78]$, and $z_4 \in [1.9, 4.5]$

B. $z_1 \in [-5.2, -4.9]$, $z_2 \in [-0.62, -0.5]$, $z_3 \in [1.46, 1.56]$, and $z_4 \in [1.9, 4.5]$

C. $z_1 \in [-4.5, -1.9]$, $z_2 \in [-0.8, -0.62]$, $z_3 \in [1.62, 1.74]$, and $z_4 \in [3.6, 5.7]$

D. $z_1 \in [-4.5, -1.9]$, $z_2 \in [-0.25, -0.17]$, $z_3 \in [4.88, 5.04]$, and $z_4 \in [3.6, 5.7]$

E. $z_1 \in [-4.5, -1.9]$, $z_2 \in [-1.51, -1.43]$, $z_3 \in [0.59, 0.62]$, and $z_4 \in [3.6, 5.7]$

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4. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{20x^3 + 62x^2 - 16}{x + 3}$$

A. $a \in [-60, -57], b \in [242, 243], c \in [-730, -721]$, and $r \in [2161, 2168]$.

B. $a \in [-60, -57], b \in [-119, -110], c \in [-354, -349]$, and $r \in [-1080, -1074]$.

C. $a \in [18, 23], b \in [-2, 7], c \in [-13, -1]$, and $r \in [-2, 3]$.

D. $a \in [18, 23], b \in [-18, -15], c \in [70, 76]$, and $r \in [-311, -303]$.

E. $a \in [18, 23], b \in [120, 128], c \in [364, 373]$, and $r \in [1076, 1088]$.

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5. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{10x^3 - 30x^2 + 43}{x - 2}$$

A. $a \in [16, 23], b \in [9, 11], c \in [12, 29]$, and $r \in [81, 88]$.

B. $a \in [16, 23], b \in [-70, -67], c \in [139, 141]$, and $r \in [-239, -231]$.

C. $a \in [6, 13], b \in [-20, -15], c \in [-21, -18]$, and $r \in [21, 24]$.

D. $a \in [6, 13], b \in [-19, -7], c \in [-21, -18]$, and $r \in [-1, 4]$.

E. $a \in [6, 13], b \in [-50, -48], c \in [95, 104]$, and $r \in [-158, -154]$.

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6. Factor the polynomial below completely, knowing that $x+4$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 8x^4 - 10x^3 - 101x^2 + 238x - 120$$

A. $z_1 \in [-2.15, -1.66]$, $z_2 \in [-1.58, -1.33]$, $z_3 \in [-0.52, -0.16]$, and $z_4 \in [3.33, 4.3]$

B. $z_1 \in [-4.34, -3.6]$, $z_2 \in [0.46, 0.95]$, $z_3 \in [1.97, 2.28]$, and $z_4 \in [2.01, 2.65]$

C. $z_1 \in [-2.68, -2.27]$, $z_2 \in [-2.16, -1.71]$, $z_3 \in [-0.92, -0.7]$, and $z_4 \in [3.33, 4.3]$

D. $z_1 \in [-4.34, -3.6]$, $z_2 \in [0.37, 0.42]$, $z_3 \in [1.07, 1.43]$, and $z_4 \in [0.8, 2.23]$

E. $z_1 \in [-3.35, -2.63]$, $z_2 \in [-2.16, -1.71]$, $z_3 \in [-0.64, -0.62]$, and $z_4 \in [3.33, 4.3]$

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7. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 20x^3 - 43x^2 - 3x + 18$$

A. $z_1 \in [-1.74, -1.55]$, $z_2 \in [1.33, 1.4]$, and $z_3 \in [1.74, 2.19]$

B. $z_1 \in [-2.07, -1.88]$, $z_2 \in [-0.9, -0.68]$, and $z_3 \in [0.53, 0.61]$

C. $z_1 \in [-2.07, -1.88]$, $z_2 \in [-0.47, 0.06]$, and $z_3 \in [2.75, 3.01]$

D. $z_1 \in [-0.8, -0.48]$, $z_2 \in [0.43, 0.86]$, and $z_3 \in [1.74, 2.19]$

E. $z_1 \in [-2.07, -1.88]$, $z_2 \in [-1.41, -1.21]$, and $z_3 \in [1.07, 1.95]$

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8. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 25x^3 + 50x^2 - 9x - 18$$

A. $z_1 \in [-3.1, -2.6]$, $z_2 \in [0.06, 0.51]$, and $z_3 \in [1.92, 2.63]$

B. $z_1 \in [-1.9, -0.7]$, $z_2 \in [1.54, 1.86]$, and $z_3 \in [1.92, 2.63]$

C. $z_1 \in [-1.5, 0.1]$, $z_2 \in [0.29, 1.22]$, and $z_3 \in [1.92, 2.63]$

D. $z_1 \in [-2.1, -1.8]$, $z_2 \in [-1.91, -1.44]$, and $z_3 \in [1.3, 1.89]$

E. $z_1 \in [-2.1, -1.8]$, $z_2 \in [-1.34, -0.43]$, and $z_3 \in [0.54, 0.97]$

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9. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{10x^3 - 29x^2 - 50x + 26}{x - 4}$$

A. $a \in [38, 42]$, $b \in [130, 134]$, $c \in [471, 482]$, and $r \in [1920, 1925]$.

B. $a \in [5, 15]$, $b \in [-73, -61]$, $c \in [220, 231]$, and $r \in [-883, -870]$.

C. $a \in [38, 42]$, $b \in [-190, -187]$, $c \in [704, 707]$, and $r \in [-2800, -2793]$.

D. $a \in [5, 15]$, $b \in [0, 4]$, $c \in [-47, -45]$, and $r \in [-117, -112]$.

E. $a \in [5, 15]$, $b \in [9, 14]$, $c \in [-13, -3]$, and $r \in [0, 7]$.

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10. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{10x^3 - 85x^2 + 200x - 129}{x - 5}$$

A. $a \in [49, 53]$, $b \in [-335, -331]$, $c \in [1872, 1879]$, and $r \in [-9510, -9502]$.

B. $a \in [3, 11]$, $b \in [-136, -134]$, $c \in [875, 882]$, and $r \in [-4504, -4494]$.

C. $a \in [3, 11]$, $b \in [-41, -33]$, $c \in [25, 28]$, and $r \in [-4, 1]$.

D. $a \in [49, 53]$, $b \in [164, 171]$, $c \in [1020, 1033]$, and $r \in [4988, 5000]$.

E. $a \in [3, 11]$, $b \in [-45, -44]$, $c \in [18, 23]$, and $r \in [-51, -48]$.
